PBEEEP
State Government

Public Buildings Enhanced Energy Efficiency Program

Final Report
Investigation Results For
Fond du Lac Tribal and Community College

Date: 4/25/2012

Minnesota
STATE COLLEGES
& UNIVERSITIES

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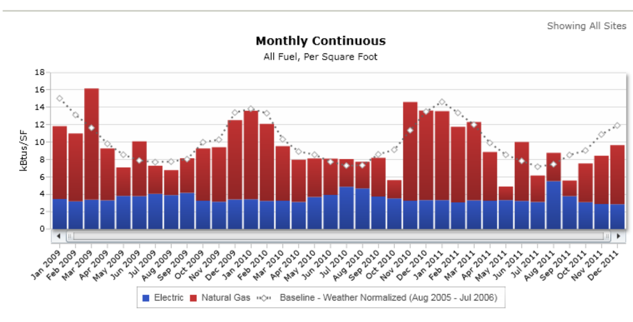
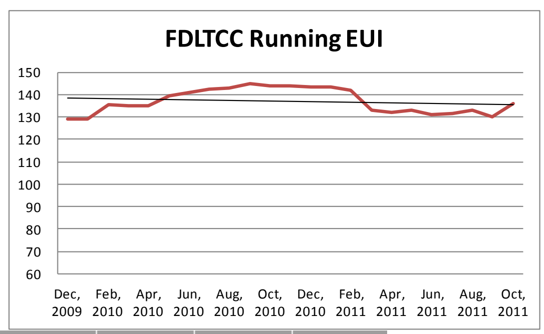
Fond du Lac Tribal and Community College Energy Investigation Overview

The goal of a PBEEEP Energy Investigation is to identify energy savings opportunities with a payback of fifteen years or less. Particular emphasis is on finding those opportunities that will generate savings with a relatively fast (1 to 5 years) and certain payback. During the investigation phase the provider conducts a rigorous analysis of the building operations. Through observation, targeted functional testing, and analysis of extensive trend and portable logger data, the RCx Provider identifies deficiencies in the operation of the mechanical equipment, lighting, envelope, and related controls. The investigation of Fond du Lac Tribal and Community College was performed by Hammel, Green and Abrahamson, Inc. This report is the result of that information.

Payback Information and Energy Savings					
Total project costs (Without Co-funding)			**Project costs with Co-funding**	
Total costs to date including study	$53,277		Total Project Cost	$98,310
Future costs including Implementation , Measurement & Verification	$45,033		Study and Administrative Cost Paid with ARRA Funds	($53,277)
Total Project Cost	$98,310		Utility Co-funding	($0)
			Total costs after co-funding	$45,033
Estimated Annual Total Savings ($)	$16,453		Estimated Annual Total Savings ($)	$16,453
Total Project Payback	6.0		Total Project Payback with co-funding	2.7
Electric Energy Savings (33,206 of 2,442,545 kWh)	**1.4%**	**and**	**Natural Gas Savings (19,444 of 137,802 Therms (2010))**	**14.1%**





Year	Days	SF	Total kBtu	Normalized Baseline kBtu	Change from Baseline kBtu	% Change	Total Energy Cost $	Average Cost Rate $ /kBtu
2009	365	188,122	22,328,345	23,164,756	-836,411	-4%	$304,552.03	$0.01
2010	365	188,122	22,045,881	22,541,048	-495,167	-2%	$304,136.49	$0.01
2011	365	188,122	20,201,776	22,797,005	-2,595,229	-11%	$275,823.81	$0.01

Fond du Lac Tribal and Community College Consumption Report
Total energy use was constant during the period of the investigation

Admin Minnesota
STATE OF MINNESOTA B3 BENCHMARKING

Summary Tables

BCA St. Paul Building	
Location	2101 14th St, Cloquet, MN 55720
Facility Manager	Mark Bernhardson
Interior Square Footage	140,650
PBEEEP Provider	Hammel, Green and Abrahamson, Inc.
Annual Energy Cost	$ 304,136 (2010) Source: B3
Utility Company	Electric: Minnesota Power Natural Gas: MN Energy Resources
Site Energy Use Index (EUI)	133kBtu/ft^2 (at start of study) 135 kBtu/ft^2 (at end of study)
Benchmark EUI (from B3)	146 kBtu/ft^2

Building Name	State ID	Area (Square Feet)	Year Built
Main	E26163C0192	54,230	1992
Academic Expansion	E26163C0302	39,720	2002
Lester Jack Briggs Cultural Center	E26163C0608	34,300	2007
Ruth A Myers Library Expansion	E26163C0508	12,400	2007

Mechanical Equipment Summary Table (of buildings included in the investigation)

Quantity	Equipment Description
2	Building Automation Systems (Honeywell and Johnson Controls)
14	Air Handlers
183	VAV Boxes
27	Exhaust Fans
38	Unit Heaters and Cabinet Unit Heaters
2	Chillers
14	Hot Water Boilers
30	Pumps (HW, CHW, etc)
6	Humidifiers
1,500	Approximate number of points available for trending
671	Minimum points recommended for trending

Implementation Information			
Estimated Annual Total Savings ($)			$16,453
Total Estimated Implementation Cost ($)			$42,033
GHG Avoided in U.S Tons (CO2e)			136
Electric Energy Savings (kWh) 1.4 % Savings 2010 Electric Usage 2,442,545 kWh (from B3)			33,206
Electric Demand Savings (Peak kW) 0 % Savings			0
Natural Gas Savings 14.1% Savings 2010 Natural Gas Usage 137,802Thermsfrom B3			19,444
Statistics			
Number of Measures identified			2
Number of Measures with payback < 3 years			1
Screening Start Date	11/4/2010	Screening End Date	3/11/2011
Investigation Start Date	6/21/2011	Investigation End Date	3/18/2012
Final Report	4/26/2012		

Fond du Lac Tribal and Community College Cost Information			
Phase		**To date**	**Estimated**
Screening		$3,734	
Investigation [Provider]		$31,000	
Investigation [CEE]		$2,133	$1,000
Implementation		$16,410	$42,033
Implementation [CEE]			$1,000
Measurement & Verification		0	$1,000
Total		$53,277	$45,033

Co-funding Summary	
Study and Administrative Cost	$36,867
Utility Co-Funding - Estimated Total ($)	$0
Building Automation System Upgrade	$16,410
Total Co-funding ($)	$53,277

Facility Overview

The energy investigation identified 6.7% of total energy savings at Fond du Lac Tribal and Community College with measures that payback in less than 15 years and do not adversely affect occupant comfort. The energy savings opportunities identified at Fond du Lac Tribal and Community College are based on correcting sensor setpoints to adjust the amount of outside air being brought in to the building, repairing several leaking valves that result in heating when it is not desired, using demand control ventilation and installing a variable speed drive on the air handling unit in the Cultural Center. The total cost of implementing all the measures is $42,033.

Implementing all these measures can save the college approximately $16,453 a year with a combined payback period of 2.6 years before rebates based on the implementation cost only (excluding study and administrative costs). These measures will produce 1.4% electrical savings and 14.1% natural gas savings. The building is currently performing at 8% below the Minnesota Benchmarking and Beyond database (B3) benchmark.

The primary energy intensive systems at Fond du Lac Tribal and Community College are described here:

The Fond du Lac Tribal and Community College serves 1,200 students. It is comprised of nine buildings totaling 173,274 square feet. The largest building on campus is the Main Building (1992), where the majority of classrooms are located and the dining and commons area reside. The school has been built in three stages; the Main building was built in 1992, the Academic Expansion happened in 2002, and the Cultural Center and Library were added in 2007. The Dormitory buildings were added to the campus in 1999 and can house up to 100 people.

Mechanical Equipment

Main Building

The Main Building has five VAV AHUs with hot water heat from the heating plant located in the basement and chilled water from the air-cooled chiller located on the roof. Each AHU also has a humidifier. There is also a furnace in the childcare center.

The heating plant consists of six identical boilers, each 534 kBtu/h, and a hot water loop for only the main building. The water is pumped around the secondary loop by a pump rated at 240gpm, but each AHU has a booster pump to ensure adequate flow rate. The cooling plant has a 188 Ton air-cooled chiller on the roof and two pumps pumping the chilled water to the five AHUs at 183gpm each.

In addition to the AHUs, the Main Building also has 18 cabinet or standard Unit Heaters and 12 Exhaust Fans. The childcare furnace has its own source of cooling, a 5 Ton DX condenser outside on the ground.

Academic Expansion Building

The Academic Expansion also has five VAV AHUs, three of which have Air-to-Air heat exchangers for the incoming minimum outside air. In addition, they have economizer dampers for additional free cooling. There are a total of 61 VAV boxes that serve the area, 30 in the south addition and 31 in the west addition. There are six cabinet or standard unit heats in the entrances and stairs. In addition, just like the Main Building, each of the AHUs get their heating and cooling from plants specific to this building.

The heating plant for the Academic Expansion has three different sized boilers and a single pump sized at 60 gpm. The cooling plant has a 67.5 Ton air-cooled chiller and a pump providing 174 gpm. There is also a server room with a separate mini-split system that provides 1.5 Tons of cooling.

Cultural Center Building

The Cultural Center contains a gym and 2 stories of classrooms. There are two AHU's: one constant volume system for the Gym and one VAV system for the classrooms. The VAV system has 29 VAV boxes and 56.4 Tons of DX cooling, while the gym system has 57.75 Tons of DX cooling. Both systems have hot water heat, which is provided by three identical boilers and a pump delivering 250 gpm to the secondary loop. There are also three primary loop pumps that run at 88 gpm, one for each boiler. There are five exhaust fans and three unit heaters.

Library Building

One AHU serves the Library. It is a VAV system with 20 VAV boxes. The AHU has 28.5 Tons of DX cooling and hot water heat provided by two small identical boilers. There are nine cabinet unit heaters and four exhaust fans.

Controls and Trending

The equipment at Fond du Lac is controlled by two different automation systems, one Johnson Controls system, and one Honeywell system. The Johnson Controls system is a Metasys system and covers the entire campus except for the Academic Expansion building. It is covered by a Honeywell SymmetrE system. The JCI system was upgraded to improve its ability to trend points as a part of this project. The Honeywell system is capable of trending and data extraction. The entire campus has DDC actuation and control. Remote access is possible for both systems.

Lighting

Almost all of the lighting is T8 lighting with occupancy sensors on most offices and classrooms. There is some 175W Metal Halide HID lighting with photocells for the parking lots.

Energy Use Index and B3 Benchmark

The site Energy Use Index (EUI) for all buildings is 133 kBtu/sq ft, which is 8% lower than their B3 Benchmark of 146 kBtu/sq ft. The median site EUI for State of Minnesota buildings are 23% lower than their corresponding B3 Benchmarks. The average EUI for MNSCU campuses is 88 kBtu/sq ft.

Metering

There are four electric meters and five gas meters. The Main building, Academic Expansion, Lester Jack Briggs Cultural Center, and Ruth A Myers Library Expansion is all on one electric and one gas meter. The Student Housing and Teacher Education Building is on another electric meter, but they are on separate gas meters. House 1 and 2 are both on their own electric and gas meters.

Findings Summary

Building: Fond du Lac Tribal and Community College
Site: Fond du Lac Tribal CC

Eco #	Investigation Finding	Total Cost	Savings	Payback	Co-Funding	Payback Co-Funding	GHG
5	Mixed Air Temperature Setpoint and Outdoor Air Level	$3,540	$3,674	0.96	$0	0.96	29
6	AHU-5 Damper Operation	$2,360	$1,837	1.28	$0	1.28	15
4	HW Coil Leaking Valve	$12,000	$7,718	1.55	$0	1.55	62
2	Auditorium AHU-3 VFD	$2,720	$1,237	2.20	$0	2.20	12
8	Daycare AHU-6	$2,000	$337	5.93	$0	5.93	3
3	Auditorium AHU-3 CO2 Monitoring	$4,393	$468	9.40	$0	9.40	4
1	Cultural Center AHU-8 VFD	$15,020	$1,181	12.71	$0	12.71	12
7	Boiler Connection	$0	$0	0.00	$0	0.00	0
	Total for Findings with Payback 3 years or less:	**$20,620**	**$14,467**	**1.43**	**$0**	**1.43**	**118**
	Total for all Findings:	**$42,033**	**$16,453**	**2.55**	**$0**	**2.55**	**136**

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Investigation Checklist

PBEEEP State Government

Rev. 2.0 (12/16/2010)

14700 - Fond du Lac TCC

This checklist is designed to be a resource and reference for Providers and PBEEEP.

Finding Category	Finding Type Number	Finding Type	Relevant Findings (if any)	Finding Location	Reason for no relevant finding	Notes
a. Equipment Scheduling and Enabling:	a.1 (1)	Time of Day enabling is excessive	AHU-6 Daycare	Daycare Furnace		According to BAS, unit is supposed to operate based off schedule. When looking at trend data, the unit appears to operate 24/7
	a.2 (2)	Equipment is enabled regardless of need, or such enabling is excessive	AHU's w/ VFD	AHU's with VFD's		While looking at ahu's w/VFD's, it appears the VFD's are not modulating as intended. The additional word document points out it would be beneficial to work with controls contractor to verify if static pressure setpoints are appropritate.
	a.3 (3)	Lighting is on more hours than necessary.			Not cost-effective to investigate	Lighting is on schedules, verified with late site visit. Only emergency lighting was on.
	a.4 (4)	OTHER_Equipment Scheduling/Enabling			Not Relevant	
b. Economizer/Outside Air Loads:	b.1 (5)	Economizer Operation – Inadequate Free Cooling (Damper failed in minimum or closed position, economizer setpoints not optimized)			Not cost-effective to investigate	With limited trend data for summer/shoulder, difficult to evaluate all ahu's ventilation rates. Found other forms of ventilation savings at facility.
	b.2 (6)	Over-Ventilation – Outside air damper failed in an open position. Minimum outside air fraction not set to design specifications or occupancy.	AHU-3 North Penthouse and Academic Expansion AHU's	Mech Rooms		AHU-3 North, the damper linkage is disconnected. Included in additional word document. Also, suggesting a sequence change for AHU-1,2,3,5 in academic expansion. AHU-4 is currently not controlling to anything and has minimal OA. AHU-4 included in word document.
	b.3 (7)	OTHER_Economizer/OA Loads			Not Relevant	
c. Controls Problems:	c.1 (8)	Simultaneous Heating and Cooling is present and excessive	AHU 1,3,4,5 1992 bldg and AHU-6 library	Mech Rooms		These HW valves appear to be leaking, therefore in the summer causes the heating and cooling.
	c.2 (9)	Sensor/Thermostat needs calibration, relocation/shielding, and/or replacement			Investigation looked for, but did not find this issue.	
	c.3 (10)	Controls "hunt" and/or need Loop Tuning or separation of heating/cooling setpoints			Investigation looked for, but did not find this issue.	
	c.4 (11)	OTHER_Controls			Not Relevant	
d. Controls (Setpoint Changes):	d.1 (12)	Daylighting controls or occupancy sensors need optimization.			Not Relevant	Did not encounter any daylighting controls.
	d.2 (13)	Zone setpoint setup/setback are not implemented or are sub-optimal.			Investigation looked for, but did not find this issue.	
	d.3 (14)	Fan Speed Doesn't Vary Sufficiently	AHU's w/ VFD	AHU's with VFD's		While looking at ahu's w/VFD's, it appears the VFD's are not modulating as intended. The additional word document points out it would be beneficial to work with controls contractor to verify if static pressure setpoints are appropritate.
	d.4 (15)	Pump Speed Doesn't Vary Sufficiently			Not cost-effective to investigate	Most pumps are relatively small or do not have VFD's.
	d.5 (16)	VAV Box Minimum Flow Setpoint is higher than necessary			Investigation looked for, but did not find this issue.	Looked at VAV trends and did not see this issue.
	d.6 (17)	Other_Controls (Setpoint Changes)			Not Relevant	
e. Controls (Reset Schedules):	e.1 (18)	HW Supply Temperature Reset is not implemented or is sub-optimal			Investigation looked for, but did not find this issue.	Only able to verify during one season for most of facility.
	e.2 (19)	CHW Supply Temperature Reset is not implemented or is sub-optimal			Not Relevant	Did not receive sufficient trend data related to chilled water.
	e.3 (20)	Supply Air Temperature Reset is not implemented or is sub-optimal			Investigation looked for, but did not find this issue.	Only able to verify during one season for most of facility.
	e.4 ( )	Supply Duct Static Pressure Reset is not implemented or is sub-optimal	AHU's w/ VFD	AHU's with VFD's		While looking at ahu's w/VFD's, it appears the VFD's are not modulating as intended. The additional word document points out it would be beneficial to work with controls contractor to verify if static pressure setpoints are appropritate.
	e.5 (21)	Condenser Water Temperature Reset is not implemented or is sub-optimal			Not Relevant	No cooling tower.
	e.6 (22)	Other_Controls (Reset Schedules)				
f. Equipment Efficiency Improvements / Load Reduction:	f.1 (23)	Daylighting Control needs optimization—Spaces are Over-Lit			Not Relevant	Did not encounter any daylighting controls.
	f.2 (24)	Pump Discharge Throttled				
	f.3 (25)	Over-Pumping			Investigation looked for, but did not find this issue.	

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14700 - Fond du Lac TCC

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Finding Category	Finding Type Number	Finding Type	Relevant Findings (if any)	Finding Location	Reason for no relevant finding	Notes
	f.4 (26)	Equipment is oversized for load.				
	f.5 (27)	OTHER_Equipment Efficiency/Load Reduction			Not Relevant	
g. Variable Frequency Drives (VFD):	g.1 (28)	VFD Retrofit - Fans	AHU-8 GYMN	Mech Room		Providing AHU-8 with a VFD to modulate airflow instead of DAT to maintain space temperature.
	g.2 (29)	VFD Retrofit - Pumps			Not cost-effective to investigate	Pumps without VFD's are small.
	g.3 (30)	VFD Retrofit - Motors (process)			Not Relevant	
	g.4 (31)	OTHER_VFD	AHU-3 Auditorium	Mech Room		Suggestion to alter sequence to allow VFD to modulate to maintain space temperature instead of modulating DAT.
h. Retrofits:	h.1 (32)	Retrofit - Motors			Not Relevant	
	h.2 (33)	Retrofit - Chillers			Not cost-effective to investigate	Newer chillers around facility.
	h.3 (34)	Retrofit - Air Conditioners (Air Handling Units, Packaged Unitary Equipment)			Not Relevant	
	h.4 (35)	Retrofit - Boilers	Boiler Operation	Mech Rooms		Potential for HW savings by connecting boiler systems to one common loop. Also, 1992 boilers are currently going through a seperate evaluation to be replaced and updated.
	h.5 (36)	Retrofit - Packaged Gas fired heating			Not cost-effective to investigate	AHU-6 in daycare, small gas fired residential unit. Mark indicated he would like to replace with a small AHU, minimal baseline energy consumption would make a payback for an AHU difficult.
	h.6 (37)	Retrofit - Heat Pumps			Not Relevant	No heat pumps in scope.
	h.7 (38)	Retrofit - Equipment (custom)			Not Relevant	
	h.8 (39)	Retrofit - Pumping distribution method	Boiler Operation	Mech Rooms		Potential for HW savings by connecting boiler systems to one common loop.
	h.9 (40)	Retrofit - Energy/Heat Recovery	AHU-2,3 Academic Expansion			
	h.10 (41)	Retrofit - System (custom)			Not Relevant	
	h.11 (42)	Retrofit - Efficient Lighting			Not cost-effective to investigate	Most lighting has already been updated to T-8's. Minimal opportunity for lighting upgrades.
	h.12 (43)	Retrofit - Building Envelope			Not Relevant	
	h.13 (44)	Retrofit - Alternative Energy			Not Relevant	
	h.14 (45)	OTHER_Retrofit			Not Relevant	
i. Maintenance Related Problems:	i.1 (46)	Differed Maintenance from Recommended/Standard			Not Relevant	
	i.2 (47)	Impurity/Contamination			Not Relevant	
	i.3 ( )	Leaky/Stuck Damper	AHU-3 North Penthouse	Mech Rooms		AHU-3 South, the damper linkage is disconnected. Included in additional word document.
	i.4 ( )	Leaky/Stuck Valve	AHU 1,3,4,5 1992 bldg and AHU-6 library	Mech Rooms		These HW valves appear to be leaking, therefore in the summer causes the heating and cooling.
	i.5 (48)	OTHER_Maintenance			Not Relevant	
j. OTHER	j.1 (49)	OTHER			Not Relevant	

Findings Glossary: Findings Examples

a.1 (1)	**Time of Day enabling is excessive**
	• HVAC running when building is unoccupied. Equipment schedule doesn't follow building occupancy • Optimum start-stop is not implemented • Controls in hand
a.2 (2)	**Equipment is enabled regardless of need, or such enabling is excessive**
	• Fan runs at 2" static pressure. Lowering pressure to 1.8" does not create comfort problem and the flow is per design. • Supply air temperature and pressure reset: cooling and heating
a.3 (3)	**Lighting is on more hours than necessary**
	• Lighting is on at night when the building is unoccupied • Photocells could be used to control exterior lighting • Lighting controls not calibrated/adjusted properly
a.4 (4)	**OTHER Equipment Scheduling and Enabling**
	• Please contact PBEEEP Project Engineer for approval
b.1 (5)	**Economizer Operation – Inadequate Free Cooling**
	• Economizer is locked out whenever mechanical cooling is enabled (non-integrated economizer) • Economizer linkage is broken • Economizer setpoints could be optimized • Plywood used as the outdoor air control • Damper failed in minimum or closed position
b.2 (6)	**Over-Ventilation**
	• Demand-based ventilation control has been disabled • Outside air damper failed in an open position • Minimum outside air fraction not set to design specifications or occupancy
b.3 (7)	**OTHER Economizer/Outside Air Loads**
	• Please contact PBEEEP Project Engineer for approval
c.1 (8)	**Simultaneous Heating and Cooling is present and excessive**
	• For a given zone, CHW and HW systems are unnecessarily on and running simultaneously • Different setpoints are used for two systems serving a common zone
c.2 (9)	**Sensor / Thermostat needs calibration, relocation / shielding, and/or replacement**
	• OAT temperature is reading 5 degrees high, resulting in loss of useful economizer operation • Zone sensors need to be relocated after tenant improvements • OAT sensor reads high in sunlight
c.3 (10)	**Controls "hunt" / need Loop Tuning or separation of heating/cooling setpoints**
	• CHW valve cycles open and closed • System needs loop tuning – it is cycling between heating and cooling
c.4 (11)	**OTHER Controls**
	• Please contact PBEEEP Project Engineer for approval
d.1 (12)	**Daylighting controls or occupancy sensors need optimization**
	• Existing controls are not functioning or overridden • Light sensors improperly placed or out of calibration
d.2 (13)	**Zone setpoint setup / setback are not implemented or are sub-optimal**
	• The cooling setpoint is 74 ºF 24 hours per day
d.3 (14)	**Fan Speed Doesn't Vary Sufficiently**
	• Fan runs at 2" static pressure. Lowering pressure to 1.8" does not create comfort problem and the flow is per design. • Supply air temperature and pressure reset: cooling and heating

d.4 (15)	**Pump Speed Doesn't Vary Sufficiently**	
		• Pump runs at 15 PSI on peak day. Lowering pressure to 12 does not create comfort problem and the flow is per design. Low ΔT across the chiller during low load conditions.
d.5 (16)	**VAV Box Minimum Flow Setpoint is higher than necessary**	
		• Boxes universally set at 40%, regardless of occupancy. Most boxes can have setpoints lowered and still meet minimum airflow requirements.
d.6 (17)	**Other Controls (Setpoint Changes)**	
		• Please contact PBEEEP Project Engineer for approval
e.1 (18)	**HW Supply Temperature Reset is not implemented or is sub-optimal**	
		• HW supply temperature is a constant 180 ºF. It should be reset based on demand, or decreased by a reset schedule as OAT increases. • DHW Setpoints are constant 24 hours per day
e.2 (19)	**CHW Supply Temperature Reset is not implemented or is sub-optimal**	
		• CHW supply temperature is a constant 42 ºF. It could be reset, based on demand or ambient temperature.
e.3 (20)	**Supply Air Temperature Reset is not implemented or is sub-optimal**	
		• The SAT is constant at 55 ºF. It could be reset to minimize reheat and maximize economizer cooling. The reset should ideally be based on demand (e.g., looking at zone box damper positions), but could also be reset based on OAT.
e.4 ( )	**Supply Duct Static Pressure Reset is not implemented or is suboptimal**	
		• The Duct Static Pressure (DSP) is constant at 1.5" wc. It could be reset to minimize fan energy. The reset should ideally be based on demand (e.g. looking at zone box damper positions), but could also be reset based on OAT.
e.5 (21)	**Condenser Water Temperature Reset is not implemented or is sub-optimal**	
		• CW temperature is constant leaving the tower at 85 ºF. The temperature should be reduced to minimize the total energy use of the chiller and tower. It may be worthwhile to reset based on load and ambient conditions.
e.6 (22)	**Other Controls (Reset Schedules)**	
		• Please contact PBEEEP Project Engineer for approval
f.1 (23)	**Lighting system needs optimization - Spaces are overlit**	
		• Lighting exceeds ASHRAE or IES standard levels for specific space types or tasks
f.2 (24)	**Pump Discharge Throttled**	
		• The discharge valve for the CHW pump is 30% open. The valve should be opened and the impeller size reduced to provide the proper flow without throttling.
f.3 (25)	**Over-Pumping**	
		• Only one CHW pump runs when one chiller is running. However, due to the reduced pressure drop in the common piping, the pump is providing much greater flow than needed.
f.4 (26)	**Equipment is oversized for load**	
		• The equipment cycles unnecessarily • The peak load is much less than the installed equipment capacity

f.5 (27)	**OTHER Equipment Efficiency/Load Reduction**	
		• Please contact PBEEEP Project Engineer for approval
g.1 (28)	**VFD Retrofit Fans**	
		• Fan serves variable flow system, but does not have a VFD. • VFD is in override mode, and was found to be not modulating.
g.2 (29)	**VFD Retrofit - Pumps**	
		• 3-way valves are used to maintain constant flow during low load periods. • Only one CHW pumps runs when one chiller is running. However, due to the reduced pressure drop in the common piping, the pump is providing much greater flow than needed.
g.3 (30)	**VFD Retrofit - Motors (process)**	
		• Motor is constant speed and uses a variable pitch sheave to obtain speed control.
g.4 (31)	**OTHER VFD**	
		• Please contact PBEEEP Project Engineer for approval
h.1 (32)	**Retrofit - Motors**	
		• Efficiency of installed motor is much lower than efficiency of currently available motors
h.2 (33)	**Retrofit - Chillers**	
		• Efficiency of installed chiller is much lower than efficiency of currently available chillers
h.3 (34)	**Retrofit - Air Conditioners (Air Handling Units, Packaged Unitary Equipment)**	
		• Efficiency of installed air conditioner is much lower than efficiency of currently available air conditioners
h.4 (35)	**Retrofit - Boilers**	
		• Efficiency of installed boiler is much lower than efficiency of currently available boilers
h.5 (36)	**Retrofit - Packaged Gas-fired heating**	
		• Efficiency of installed heaters is much lower than efficiency of currently available heaters
h.6 (37)	**Retrofit - Heat Pumps**	
		• Efficiency of installed heat pump is much lower than efficiency of currently available heat pumps
h.7 (38)	**Retrofit - Equipment (custom)**	
		• Efficiency of installed equipment is much lower than efficiency of currently available equipment
h.8 (39)	**Retrofit - Pumping distribution method**	
		• Current pumping distribution system is inefficient, and could be optimized. • Pump distribution loop can be converted from primary to primary-secondary)
h.9 (40)	**Retrofit - Energy / Heat Recovery**	
		• Energy is not recouped from the exhaust air. • Identification of equipment with higher effectiveness than the current equipment.
h.10 (41)	**Retrofit - System (custom)**	
		• Efficiency of installed system is much lower than efficiency of another type of system
h.11 (42)	**Retrofit - Efficient lighting**	
		• Efficiency of installed lamps, ballasts or fixtures are much lower than efficiency of currently available lamps, ballasts or fixtures.

h.12 (43)	**Retrofit - Building Envelope**	
		• Insulation is missing or insufficient • Window glazing is inadequate • Too much air leakage into / out of the building • Mechanical systems operate during unoccupied periods in extreme weather
h.13 (44)	**Retrofit - Alternative Energy**	
		• Alternative energy strategies, such as passive/active solar, wind, ground sheltered construction or other alternative, can be incorporated into the building design
h.14 (45)	**OTHER Retrofit**	
		• Please contact PBEEEP Project Engineer for approval
i.1 (46)	**Differed Maintenance from Recommended/Standard**	
		• Differed maintenance that results in sub-optimal energy performance. • Examples: Scale buildup on heat exchanger, broken linkages to control actuator missing equipment components, etc.
i.2 (47)	**Impurity/Contamination**	
		• Impurities or contamination of operating fluids that result in sub-optimal performance. Examples include lack of chemical treatment to hot/cold water systems that result in elevated levels of TDS which affect energy efficiency.
i.3 ( )	**Leaky/Stuck Damper**	
		• The outside or return air damper on an AHU is leaking or is not modulating causing the energy use go up because of additional load to the central heating and/or cooling plant.
i.4 ( )	**Leaky/Stuck Valve**	
		• The heating or cooling coil valve on an AHU is leaking or is not modulating causing the energy use go up because of additional load to the central heating and/or cooling plant.
i.5 (48)	**OTHER Maintenance**	
		• Please contact PBEEEP Project Engineer for approval
j.1 (49)	**OTHER**	
		• Please contact PBEEEP Project Engineer for approval

Findings Details

Building: Fond du Lac Tribal and Community College

FWB Number:	14700	Eco Number:	1
Site:	Fond du Lac Tribal CC	Date/Time Created:	4/20/2012

Investigation Finding:	Cultural Center AHU-8 VFD	Date Identified:	2/13/2012
Description of Finding:	The gym air handling unit currently operates as a constant volume unit and adjusts discharge air temperature to maintain the space temperature setpoint. Implementing a VFD on the supply and return fans could save on fan energy by modulating the fan speed to maintain the zone temperature setpoint instead of modulating the discharge air temperature.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Variable Frequency Drives (VFD)
Finding Type:	VFD Retrofit - Fans		

Implementer:	In house staff, controls contractor, and electrical contractor	Benefits:	Energy savings
Baseline Documentation Method:	Trending of the fan status, DAT, MAT, RAT, Zone Temperature, damper position, CO2 level, heating valve position, and cooling present value will help in evaluating the baseline operation of the AHU. Spot measurement of amperage and voltage of the supply fan and return fan will be used in calculating the baseline fan energy for the AHU. The DAT should modulate to maintain the zone temperature setpoints.		
Measure:	Implementing a VFD on the supply and return fans as well as altering the sequence of operation will result in fan energy savings.		
Recommendation for Implementation:	The recommendation is to provide appropriately sized VFD's for both the supply and return fans. Contractor to install VFD's for each fan motor. The return fan VFD shall modulate to maintain a static pressure setpoint downstream of the return air fan. Controls contractor and engineer to determine appropriate location of pressure sensor. Controls contractor to provide VFD interface on BAS and alter sequence as required. Sequence of operation to modulate fan speed to maintain zone temperature setpoint. Space heating sequence is to operate fan speed at minimum and modulate heating valve to maintain DAT. Fan speed shall modulate to maintain zone temperature setpoint. When unit operates in cooling mode (non-economizer cooling) airflow to maintain minimum face velocity as air handling unit is a split DX system. Sequence of operation is similar to sequence for a VAV box with reheat.		
Evidence of Implementation Method:	Evidence shall be provided through the use of the trend data. Trending of MAT, DAT, RAT, Zone Temperature, CO2 level, damper position, HW valve position, cooling stage, supply and return VFD fan speed will demonstrate energy savings related to fan operation. Trending over a two week period during both summer, winter, and shoulder seasons shall demonstrate VFD modulation to maintain a zone temperature setpoint.		

Annual Electric Savings (kWh):	13,651	Contractor Cost ($):	$11,020
Estimated Annual kWh Savings ($):	$1,181	PBEEEP Provider Cost for Implementation Assistance ($):	$4,000
		Total Estimated Implementation Cost ($):	$15,020

Estimated Annual Total Savings ($):	$1,181	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	12.71	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	12.71	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	12	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	7.2%	Percent of Implementation Costs:	35.7%

Findings Details

PBEEEP State Government

Building: Fond du Lac Tribal and Community College

FWB Number:	14700	Eco Number:	2
Site:	Fond du Lac Tribal CC	Date/Time Created:	4/20/2012

Investigation Finding:	Auditorium AHU-3 VFD	Date Identified:	2/13/2012
Description of Finding:	The auditorium air handling unit currently operates as a constant volume unit and adjusts discharge air temperature to maintain the space temperature setpoint. Altering the controls strategy to allow the VFD to modulate to maintain space temperature setpoint could save on fan energy by modulating the fan speed to maintain the zone temperature setpoint.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Controls (Setpoint Changes)
Finding Type:	Fan Speed Doesn't Vary Sufficiently		

Implementer:	In house staff, controls contractor	Benefits:	Energy savings
Baseline Documentation Method:	Trending of the fan status, DAT, MAT, RAT, Zone Temperature, damper position, heating valve position, and cooling present value will help in evaluating the baseline operation of the AHU. Spot measurement of amperage and voltage of the supply fan and return fan will be used in calculating the baseline fan energy for the AHU.		
Measure:	Altering the sequence of operation for the supply and return fans for energy savings.		
Recommendation for Implementation:	The recommendation is to alter the sequence of operation to allow VFD's to modulate to maintain the space temperature setpoint instead of modulating the heating and cooling valves to maintain a DAT. Sequence of operation to modulate fan speed to maintain zone temperature setpoint. Space heating sequence is to operate fan speed at minimum and modulate heating valve to maintain DAT. Sequence of operation is a similar to sequence for a VAV with reheat.		
Evidence of Implementation Method:	Evidence shall be provided through the use of the trend data. Trending of MAT, DAT, RAT, Zone Temperature, CO2 level, damper position, HW valve position, cooling stage, supply and return VFD fan speed will demonstrate energy savings related to fan operation. Trending over a two week period during both summer, winter, and shoulder seasons shall demonstrate VFD modulation to maintain a zone temperature setpoint.		

Annual Electric Savings (kWh):	14,296	Contractor Cost ($):	$720
Estimated Annual kWh Savings ($):	$1,237	PBEEEP Provider Cost for Implementation Assistance ($):	$2,000
		Total Estimated Implementation Cost ($):	$2,720

Estimated Annual Total Savings ($):	$1,237	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	2.20	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	2.20	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	12	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	7.5%	Percent of Implementation Costs:	6.5%

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Details

Building: Fond du Lac Tribal and Community College

FWB Number:	14700	Eco Number:	3
Site:	Fond du Lac Tribal CC	Date/Time Created:	4/20/2012

Investigation Finding:	Auditorium AHU-3 CO2 Monitoring	Date Identified:	2/13/2012
Description of Finding:	The auditorium air handling unit serves a single zone, the auditorium. The current sequence of operation modulates the outdoor air damper position for economizer operation and maintains a minimum outdoor air damper position for remaining operation. A CO2 return air monitor would allow the OA damper position to close to save energy due to heating and cooling of outdoor air.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Economizer/Outside Air Loads
Finding Type:	Other Economizer/OA Loads		

Implementer:	In house staff, controls contractor	Benefits:	Energy savings
Baseline Documentation Method:	Trending of the fan status, DAT, MAT, RAT, Zone Temperature, damper position, heating valve position, and cooling valve position will help in evaluating the baseline operation of the AHU. The DAT should modulate to maintain the zone temperature setpoint.		
Measure:	Providing a CO2 sensor in the return air ductwork will allow outdoor air damper position to modulate off space needs and not time of day schedule.		
Recommendation for Implementation:	The recommendation is to provide a CO2 sensor in the return air ductwork to control the outdoor air damper position. The single zone space has a varying occupancy with a wide fluctuation in ventilation requirements. The CO2 sensor will reset the outdoor air damper position to provide more or less outdoor air based on a user adjustable CO2 PPM level. The outdoor air damper position will be fixed at a minimum position when the CO2 level is at accaptable levels. When the PPM raises to levels that indicate a larger population in the space, the outdoor air damper position shall modulate to increase ventilation into the space.		
Evidence of Implementation Method:	Evidence shall be provided through the use of trending of the outdoor air damper position and CO2 sensor PPM trend value. When the PPM are within accaptable limits, the outdoor air damper position shall maintain a minimum position. When the PPM are elevated, the damper position shall modulate to increase ventilation as required.		

Annual Electric Savings (kWh):	90	Annual Natural Gas Savings (therms):	658
Estimated Annual kWh Savings ($):	$8	Estimated Annual Natural Gas Savings ($):	$460
Contractor Cost ($):	$1,393		
PBEEEP Provider Cost for Implementation Assistance ($):	$3,000		
Total Estimated Implementation Cost ($):	$4,393		

Estimated Annual Total Savings ($):	$468	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	9.40	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	9.40	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	4	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	2.8%	Percent of Implementation Costs:	10.5%

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Details

PBEEEP State Government

Building: Fond du Lac Tribal and Community College

FWB Number:	14700	Eco Number:	4
Site:	Fond du Lac Tribal CC	Date/Time Created:	4/20/2012

Investigation Finding:	HW Coil Leaking Valve	Date Identified:	2/13/2012
Description of Finding:	When looking at trend data for AHU-1,3 and 4 in the 1992 building and AHU-6 in the library, it was discovered the HW valves are leaking water. This was discovered by looking at the DAT, MAT, and Hot Water Return water temperature trends. When the air handling units are in an unoccupancy mode and the supply fan is off, the DAT, MAT, and Hot Water Return water temperature values elevate dramatically. When the unit is returned to occupied mode and the supply fan is enabled, the temperatures return to normal levels. The heating of the DAT and MAT is taking place when the heating valve position maintains a trend value of 0, or closed.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Maintenance Related Problems
Finding Type:	Leaky/Stuck Valve		

Implementer:	In house staff, controls contractor, mechanical contractor	Benefits:	Energy savings
Baseline Documentation Method:	Trending of the fan status, DAT, MAT, RAT, Zone Temperature, damper position, HWS temperature, Coil HWR temperature, heating valve position, and cooling valve position will help in evaluating the baseline operation of the AHU. When the unit is in unoccupied mode, the DAT, MAT, and HWR temperature will elevate due to the lack of airflow from the fan. In addition, when the fan is in operation, the DAT is substantially higher than the MAT while the fan is operating but the HW coil valve position indicates the valve is closed. This is another indication the valve is leaking.		
Measure:	Working with the controls contractor and mechanical contractor to ensure that when the BAS signal indicates a closed position hot water valve position, the valve is properly seated so as not to allow leaking.		
Recommendation for Implementation:	The recommendation is for the facility to work with the controls contractor and mechanical contractor to ensure the valves close properly when the BAS indicates to do so. Make adjustments as required to ensure no flow is present when the valve is in the closed position.		
Evidence of Implementation Method:	Evidence shall be provided through the use of the trend data. Trending of the DAT, MAT, HWR coil temperature, and hot water valve position shall indicate the problem has been corrected. The DAT and MAT should be closely related when the hot water valve position is in the closed position. Also, the DAT and MAT should not reach extreme temperatures when the AHU is in the unoccupied mode and the fan off unless the AHU moves into a necessary freeze protection mode, in which the hot water valve modulates open during unoccupied times. Trending of the points for a two week period during heating season shall demonstate the valves are properly seated.		

Annual Electric Savings (kWh):	3,245	Annual Natural Gas Savings (therms):	10,649
Estimated Annual kWh Savings ($):	$281	Estimated Annual Natural Gas Savings ($):	$7,437
Contractor Cost ($):	$10,000		
PBEEEP Provider Cost for Implementation Assistance ($):	$2,000		
Total Estimated Implementation Cost ($):	$12,000		

Estimated Annual Total Savings ($):	$7,718	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	1.55	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	1.55	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	62	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	46.9%	Percent of Implementation Costs:	28.5%

Findings Details

Building: Fond du Lac Tribal and Community College

FWB Number:	14700	Eco Number:	5
Site:	Fond du Lac Tribal CC	Date/Time Created:	4/20/2012

Investigation Finding:	Mixed Air Temperature Setpoint and Outdoor Air Level	Date Identified:	2/13/2012
Description of Finding:	When looking at trend data for AHU 1,2 and 5 in the Academic Expansion it appears the outdoor air damper position modulates to maintain a specific mixed air temperature (MAT) low limit setpoint during cool outdoor air temperatures. The MAT appears to be set 5 to 10 degrees below the DAT. By setting the MAT equal to the DAT, the outdoor air damper would modulate to maintain the MAT equal to the DAT and would reduce the heating load on the air handling unit. This finding is about reducing the OA levels for all AHU's. In addition, it appears the outdoor airflow measuring station for AHU-1 and 2 is reading incorrectly, causing the OA damper to remain open at high temperatures.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Economizer/Outside Air Loads
Finding Type:	Over-Ventilation - Outside air damper failed in an open position. Minimum outside air fraction not set to design specifications or occupancy.		

Implementer:	In house staff, controls contractor	Benefits:	Energy savings
Baseline Documentation Method:	Trending of the MAT, DAT, RAT, damper position, heating valve position and supply and return fan speeds will demonstrate the baseline operation. Currently, it is verified the damper position opens as outdoor air temperature increases to maintain the specific MAT. Because the MAT is set below the DAT, heating occurs from minimum outdoor air temperatures to temperatures which could be accaptable for economizing but because the outdoor air levels are higher due to the MAT setpoint, the AHU is required to operate in a heating mode at much higher temperatures.		
Measure:	Working with the controls contractor to provide a sequence change as well as proper demand control ventilation with CO2 sensors will provide additional energy savings for the facility.		
Recommendation for Implementation:	The recommendation is for the facility to work with the controls contractor to alter the sequence of operation and provide CO2 sensors as required to reduce the overall outdoor air for the unit. The sequence of operation currently has a low limit mixed air temperature setpoint which controls the outdoor air damper position at low temperatures. This low limit setpoint needs to be equal to the discharge air temperature setpoint for heating savings. The sequence needs to ensure the outdoor air damper is capable of taking advantage of all economizer savings. The CO2 sensors will be provided to ensure the minimum outdoor air is being provided to the spaces for ventilation purposes at low and high outdoor air temperatures. The new minimum outdoor air CFM will be balanced to provide sufficient outdoor air to act as makeup air in the science area and to meet current ventilation standards. The facility shall work with the design engineer, controls contractor, and test and balancer to ensure damper position is set as required and controls to CO2 requirements.		
Evidence of Implementation Method:	Evidence shall be provided through the use of trending of the outdoor air damper position and CO2 sensor PPM trend value. When the PPM are within accaptable limits, the outdoor air damper position shall maintain a minimum position. When the PPM are elevated, the damper position shall modulate to increase ventilation as required.		

Annual Electric Savings (kWh):	462	Annual Natural Gas Savings (therms):	5,204
Estimated Annual kWh Savings ($):	$40	Estimated Annual Natural Gas Savings ($):	$3,634
Contractor Cost ($):	$540		
PBEEEP Provider Cost for Implementation Assistance ($):	$3,000		
Total Estimated Implementation Cost ($):	$3,540		

Estimated Annual Total Savings ($):	$3,674	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	0.96	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	0.96	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	29	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	22.3%	Percent of Implementation Costs:	8.4%

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Findings Details

PBEEEP State Government

Building: Fond du Lac Tribal and Community College

FWB Number:	14700	Eco Number:	6
Site:	Fond du Lac Tribal CC	Date/Time Created:	4/20/2012

Investigation Finding:	AHU-5 Damper Operation	Date Identified:	2/13/2012
Description of Finding:	Upon looking at trend data for AHU-5 of the Academic Expansion, it was discovered the unit operates 24/7. Upon conversations with Mark, it was discovered this unit is required to operate 24/7 for space tempering of a data area. It is possible to close the outdoor air dampers during unoccupied times for significant heating and cooling savings by reducing the outdoor air load for the air handling unit.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Economizer/Outside Air Loads
Finding Type:	Other Economizer/OA Loads		

Implementer:	In house staff, controls contractor	Benefits:	Energy savings
Baseline Documentation Method:	Trending of the MAT, DAT, RAT, damper position, heating and cooling valve position and supply and return fan speeds will demonstrate the baseline operation. Currently, it is verified the damper position opens as outdoor air temperature increases to maintain MAT. This is occuring during all hours. The trend data shows the unit operates 24/7 in this manner.		
Measure:	Altering the sequence to close the outdoor air damper during unoccupied times will result in outdoor air conditioning savings.		
Recommendation for Implementation:	The recommendation is for the facility to work with the controls contractor to alter the sequence of operation and allowthe outdoor air damper position to modulate closed during unoccupied times. Currently, the unit operates 24/7 and the outdoor air damper does not respond to an alteration in occupancy.		
Evidence of Implementation Method:	The evidence of implementation will be through the use of trend data. The outdoor air damper position as well as the MAT, DAT heating valve, cooling valve, and fan speed will all aid in verification. When the damper position closes and unit remains operational, the MAT shall be equal to the RAT. In addition, the outdoor air damper position trend shall demonstrate it is closed. A trend of two weeks during heating and cooling season will ensure damper operats as specified.		

Annual Electric Savings (kWh):	3	Annual Natural Gas Savings (therms):	2,631
Estimated Annual kWh Savings ($):	$0	Estimated Annual Natural Gas Savings ($):	$1,837
Contractor Cost ($):	$360		
PBEEEP Provider Cost for Implementation Assistance ($):	$2,000		
Total Estimated Implementation Cost ($):	$2,360		

Estimated Annual Total Savings ($):	$1,837	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	1.28	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	1.28	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	15	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	11.2%	Percent of Implementation Costs:	5.6%

Findings Details

PBEEEP State Government

Building: Fond du Lac Tribal and Community College

FWB Number:	14700	Eco Number:	7
Site:	Fond du Lac Tribal CC	Date/Time Created:	4/20/2012

Investigation Finding:	Boiler Connection	Date Identified:	2/13/2012
Description of Finding:	The boiler system for the facility is comprised of multiple boiler plants located around the facility. The boilers could potentially be connected together and operated as a single system for energy savings. The boiler connection was discovered as a potential energy savings based off the trended data of HWS/HWR and discussions between the facility engineer, CEE, and HGA about the higher than usual gas consumption for the facility when compared on a square-footage basis. Savings estimated at $5000/yr		
Equipment or System(s):	Boiler Plant	Finding Category:	Equipment Efficiency Improvements / Load Reduction
Finding Type:	Equipment is oversized for load		

Implementer:	In house staff, controls contractor, mechanical contractor	Benefits:	Energy Savings
Baseline Documentation Method:	Trending of the boiler HWS/HWR temperature, boiler status, and pump status will allow us to determine the baseline boiler system operation.		
Measure:	Connecting the boilers to create one system will help to solve the low delta T of the systems and decrease the amount the boilers potentially short cycle.		
Recommendation for Implementation:	The recommendation is for the facility to work at implementing a project to connect the boilers together to create one system. The control strategy could be to stage on the most efficient boiler as required to maintain the heating load. Another method of control would be to operate the largest plant and disable all other boilers in the system.		
Evidence of Implementation Method:	Trending of HWS/HWR, boiler status, and pump status will demonstrate the boiler system operation.		

Estimated Annual Total Savings ($):	$0	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	0.00	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	0.00	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	0	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	0.0%	Percent of Implementation Costs:	0.0%

Findings Details

PBEEEP State Government

Building: Fond du Lac Tribal and Community College

FWB Number:	14700	Eco Number:	8
Site:	Fond du Lac Tribal CC	Date/Time Created:	4/20/2012

Investigation Finding:	Daycare AHU-6	Date Identified:	2/13/2012
Description of Finding:	Currently, the Daycare AHU-6 has an operating schedule. When looking at the trend data, it was discovered the unit is operating 24/7. Energy savings could be realized by operating the AHU with respect to the designated schedule.		
Equipment or System(s):	AHU with heating and cooling	Finding Category:	Equipment Scheduling and Enabling
Finding Type:	Time of Day enabling is excessive		

Implementer:	In house staff, controls contractor	Benefits:	Energy savings
Baseline Documentation Method:	Trending of the DAT, RAT, and fan status will demonstrate the baseline operation of the furnace. It shows the unit operates 24/7 to maintain the space temperature.		
Measure:	Altering the controls will allow the AHU to operate based off the occupancy schedule.		
Recommendation for Implementation:	The recommendation is for the facility engineer to work with JCI to correct the scheduling of the Daycare AHU.		
Evidence of Implementation Method:	Trending of fan status as well as DAT and RAT will demonstrate the unit returns to the previous AHU schedule.		

Annual Electric Savings (kWh):	1,459	Annual Natural Gas Savings (therms):	302
Estimated Annual kWh Savings ($):	$126	Estimated Annual Natural Gas Savings ($):	$211
Contractor Cost ($):	$1,000		
PBEEEP Provider Cost for Implementation Assistance ($):	$1,000		
Total Estimated Implementation Cost ($):	$2,000		

Estimated Annual Total Savings ($):	$337	Utility Co-Funding for kWh ($):	$0
Initial Simple Payback (years):	5.93	Utility Co-Funding for kW ($):	$0
Simple Payback w/ Utility Co-Funding (years):	5.93	Utility Co-Funding for therms ($):	$0
GHG Avoided in U.S. Tons (C02e):	3	Utility Co-Funding - Estimated Total ($):	$0

Current Project as Percentage of Total project			
Percent Savings (Costs basis)	2.0%	Percent of Implementation Costs:	4.8%

PBEEEP was made possible with funding from the U.S. Department of Energy and the MN Department of Commerce.

Johnson Controls, Inc.
Building Efficiency
4627 Airpark Boulevard
Duluth, MN 55811
Phone: (218) 727-8996 x235
Fax: (218) 727-7945
Cell: (218) 391-8853

PROPOSAL

TO: Fond du Lac Tribal & Community College
Attn: Mark Bernhardson

DATE: 6/21/2011

PROJECT: FDLTCC Metasys – Upgrade to ADS Server

Johnson Controls proposes to perform the work described below for the net price of: ………………. $16,520.00

Deduct for software upgrade of existing network controllers (NAE's) = ……………………….. DEDUCT = $890.00

For the above price this proposal includes:
Material and labor to upgrade the existing Metasys energy management system to new web-based Application and Data Server (ADS) system:

- Furnish and install a new Application and Data Server (ADS) system (software only).
- Convert existing Metasys database and map existing controls/points to the new server.
- This system shall still provide internet access to energy management system.
- On-site training on the new system trending, features and benefits.

Benefits / Features of the new ADS server:

- Energy savings via time scheduling, demand limiting, load rolling, & trending.
- Long term trending & data storage – enables identification of energy efficiency improvements.
- Double the controller capacity of the existing network controllers.
- Microsoft Windows based – simple click and drag user interface.
- Web-based internet access to system.
- Access to system from any computer on the FDLTCC EMS network with valid username and password.
- System alarms can be sent to email addresses, pagers, or cell phones.

The above scope of work assumes that the existing temperature controls are in good working condition. The owner shall provide/allocate a computer to be used for the new Application and Data Server (ADS).

This proposal does not include:
The computer (furnished by owner - per the ADS product bulletin minimum specifications). Nor does this include the Ethernet network drop(s) and IP addresses (to be furnished by FDLTCC). Nor does this include the programming of any trends (trends will be programmed by energy consultant / engineer).

(IMPORTANT: This proposal incorporates by reference the terms and conditions on the following page)

This proposal is hereby accepted and Johnson Controls is authorized to proceed with the work; subject, however, to credit approval by Johnson Controls, Inc., Milwaukee, Wisconsin.

This proposal is valid until: 60 days

____
Purchaser -- Company Name

____
Signature

Name:_________________________________

Title: _________________________________

Date: _________________________________

JOHNSON CONTROLS, INC.

Brian C Schmidt
Signature

Name: Brian Schmidt

Title: Project Manager - Installation

Form 975-A90 (Rev. 6/88)

TERMS AND CONDITIONS

By accepting this proposal, Purchaser agrees to be bound by the following terms and conditions:

1. **SCOPE OF WORK**. This proposal is based upon the use of straight time labor only. Plastering, patching and painting are excluded. "In-line" duct and piping devices, including, but not limited to, valves, dampers, humidifiers, wells, taps, flow meters, orifices, etc., if required hereunder to be furnished by Johnson, shall be distributed and installed by others under Johnson's supervision but at no additional cost to Johnson. Purchaser agrees to provide Johnson with required field utilities (electricity, toilets, drinking water, project hoist, elevator service, etc.) without charge. Johnson agrees to keep the job site clean of debris arising out of its own operations. Purchaser shall not back charge Johnson for any costs or expenses without Johnson's written consent.
   Unless specifically noted in the statement of the scope of work or services undertaken by JCI under this agreement, JCI's obligations under this agreement expressly exclude any work or service of any nature associated or connected with the identification, abatement, clean up, control, removal, or disposal of environment Hazards or dangerous substances, to include but not be limited to asbestos or PCBs, discovered in or on the premises. Any language or provision of the agreement elsewhere contained which may authorize or empower the Purchaser to change, modify, or alter the scope of work or services to be performed by JCI shall not operate to compel JCI to perform any work relating to Hazards without JCI's express written consent.

2. **INVOICING & PAYMENTS**. Johnson may invoice Purchaser monthly for all materials delivered to the job site or to an off-sire storage facility and for all work performed on-site and off-site. Purchaser shall pay Johnson at the time purchaser signs this agreement **an advance payment equal to 10% of the contract price,** which advance payment shall be credited against the final payment (but not any progress payment) due hereunder and purchaser agrees to pay Johnson additional amounts invoiced upon receipt of the invoice. Waivers of lien will be furnished upon request, as the work progresses, to the extent payments are received. If Johnson's invoice is not paid within 30 days of its issuance, it is delinquent.

3. **MATERIALS**. If the materials or equipment included in this proposal become temporarily or permanently unavailable for reasons beyond the control and without the fault of Johnson, then in the case of such temporary unavailability, the time for performance of the work shall be extended to the extent thereof, and in the case of permanent unavailability, Johnson shall (a) be excused from furnishing said materials or equipment, and (b) be reimbursed for the difference between the cost of the materials or equipment permanently unavailable and the cost of a reasonably available substitute therefore.

4. **WARRANTY**. Johnson warrants that the equipment manufactured by it shall be free from defects in material and workmanship arising from normal usage for a period of one (1) year from delivery of said equipment, or if installed by Johnson, for a one (1) year from installation. Johnson warrants that for equipment furnished and/or installed but not manufactured by Johnson, Johnson will extend the same warranty terms and conditions which Johnson receives from the manufacturer of said equipment. For equipment installed by Johnson, if Purchaser provides written notice to Johnson for any such defect within thirty (30) days after the appearance or discovery of such defect, Johnson shall at its option, repair or replace the defective equipment. For equipment not installed by Johnson, if Purchaser returns the defective equipment to Johnson within thirty (30) days after appearance or discovery of such defect. Johnson shall, at its, option, repair or replace the defective equipment and return said equipment to Purchaser. All transportation charges incurred in connection with the warranty for equipment not installed by Johnson shall be borne by the Purchaser. These warranties do not extend to any equipment which has been repaired by others, abused, altered, or misused, or which has not been properly and reasonably maintained. THESE WARRANTIES ARE IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THOSE OF MERCHANTABILITY AND FITNESS FOR A SPECIFIC PURPOSE.

5. **LIABILITY**. Johnson shall not be liable for any special, indirect or consequential damages arising in any manner from the equipment or material furnished or the work performed pursuant to this agreement.

6. **TAXES**. The price of this proposal does not include duties, sales, use, excise, or other similar taxes, unless required by federal, state or local law. Purchaser shall pay, in addition to the stated price, all taxes not legally required to be paid by Johnson or, alternatively, shall provide Johnson with acceptable tax exemption certificates. Johnson shall provide Purchaser with any tax payment certificate upon request and after completion and acceptance of the work.

7. **DELAYS**. Johnson shall not be liable for any delay in the performance of the work resulting from or attributed to acts or circumstances beyond Johnson's control, including, but not limited to, acts of God, fire, riots, labor disputes, conditions of the premises, acts or omissions of the Purchaser, Owner, or other Contractors or delays caused by suppliers or subcontracts of Johnson, etc.

8. **COMPLIANCE WITH LAWS**. Johnson shall comply with all applicable federal, state and local laws and regulations and shall obtain all temporary licenses and permits required for the prosecution of the work. Licenses and permits of a permanent nature shall be procured and paid for by the Purchaser.

9. **ATTORNEY'S FEES**. Purchaser agrees that he will pay and reimburse Johnson for any and all reasonable attorneys' fees which are incurred by Johnson in the collection of amounts due and payable hereunder.

10. **INSURANCE**. Insurance coverage in excess of Johnson's standard limits will be furnished when requested and required. No credit will be given or premium paid by Johnson for insurance afforded by others.

11. **INDEMNITY**. The Parties hereto agree to indemnify each other from any and all liabilities, claims, expenses, losses or damages, including attorney's fees, which may arise in connection with the execution of the work herein specified and which are caused, in whole or in part, by the negligent act or omission of the indemnifying Party.

12. **OCCUPATIONAL SAFETY AND HEALTH**. The Parties hereto agree to notify each other immediately upon becoming aware of an inspection under, or any alleged violation of, the Occupational Safety and Health Act relating tin any way to the project or project site.

13. **ENTIRE AGREEMENT**. This proposal, upon acceptance, shall constitute the entire agreement between the parties and supersedes any prior representations or understandings.

14. **CHANGES**. No change or modification of any of the terms and conditions stated herein shall be binding upon Johnson unless accepted by Johnson in writing.

PBEEEP
State Government

Public Buildings Enhanced Energy Efficiency Program

ATTACHMENT 4: SCREENING RESULTS FOR FOND DU LAC TRIBAL AND COMMUNITY COLLEGE

March 14, 2011

Campus Overview

Fond du Lac TCC	
Location	2101 14th St Cloquet, MN 55720
Facility Manager	Mark Bernhardson
Number of Buildings	9
Interior Square Footage	173,274
PBEEEP Provider	Center for Energy and Environment (Gustav Brändström)
Date Visited	November 4, 2010
Annual Energy Cost	$304,136 (from 2010 utility data in B3)
Utility Company	Electric: Minnesota Power Natural Gas: MN Energy Resources
Site Energy Use Index (EUI)	133 kBtu/sq ft (from 2010 utility data)
Benchmark EUI (from B3)	146.2 kBtu/sq ft

The Fond du Lac Tribal and Community College serves 1,200 students. It is comprised of nine buildings totaling 173,274 square feet. The largest building on campus is the Main Building (1992), where the majority of classrooms are located and the dining and commons area reside. The school has been built in three stages; the Main building was built in 1992, the Academic Expansion happened in 2002, and the Cultural Center and Library were added in 2007. The Dormitory buildings were added to the campus in 1999 and can house up to 100 people. There are also four small standalone buildings: two are temporary structures on campus, and two are residential buildings off campus. There is a map of the campus at the end of this report.

Screening Overview

The goal of screening is to select buildings where an in-depth energy investigation can be performed to identify energy savings opportunities that will generate savings with a relatively short (1 to 5 years) and certain payback. The screening of the Fond du Lac was performed by the Center for Energy and Environment (CEE) with the assistance of the facility staff. A walk-through was conducted on November 4, 2010 and interviews with the facility staff were carried out to fully explore the status of the energy consuming equipment and their potential for recommissioning. This report is the result of that information.

Recommendation

A detailed investigation of the energy usage and energy savings opportunities of the four buildings listed below is recommended at this time. The floor areas listed in the table have not been verified.

Building Name	State ID	Area (sq ft)	Year Built
Main	E26163C0192	54,230	1992
Academic Expansion	E26163C0302	39,720	2002
Lester Jack Briggs Cultural Center	E26163C0608	34,300	2007
Ruth A Myers Library Expansion	E26163C0508	12,400	2007
		140,650	

There are many factors that are part of the decision to recommend an energy investigation of a building; at the Fond du Lac, some of the characteristics that were taken into account during the building selection process include:

- Potential energy savings opportunities observed during screening phase
- Many separate building with their own HVAC systems, including heating and cooling equipment, operating independently.
- Level of control by the building automation system
- Equipment size and quantity
- Support from the staff and management to include building in an investigation

Below are the remaining buildings that are not recommended for investigation. These buildings are not recommended for an investigation because they are small and have residential size furnaces with limited control.

Building Name	State ID	Area (sq ft)	Year Built
Student Housing	E26163C0299	26,900	1999
Center of Excellence	E26163C0504	1,680	2004
House 1	None	1,200	1960
House 2	None	1,500	1990
Teacher Education Building	E26163C0404	1,344	2004

Recommended Buildings Descriptions

The main building at Fond du Lac Tribal and Community College is made up of four interconnected buildings that were built over a period of 15 years. Each addition was built with a dedicated heating and cooling system and the four hot water loops are not integrated. Details obtained through the screening process regarding the recommended buildings are included below:

Mechanical Equipment Summary Table	
2	Building Automation System (Honeywell and Johnson Controls)
4	Buildings
140,650	Interior Square Feet
14	Air Handlers
183	VAV Boxes
27	Exhaust Fans
38	Unit Heaters and Cabinet Unit Heaters
2	Chillers
14	Hot Water Boilers
30	Pumps (HW, CHW, etc)
6	Humidifiers
1,500	Approximate number of points available for trending
670	Minimum points recommended for trending
0	Data Loggers Required (Does NOT include lighting loggers)

Mechanical Equipment

Main Building

The Main Building has five VAV AHUs with hot water heat from the heating plant located in the basement and chilled water from the air-cooled chiller located on the roof. Each AHU also has a humidifier. There is also a furnace in the childcare center.

The heating plant consists of six identical boilers, each 534 kBtu/h, and a hot water loop for only the main building. The water is pumped around the secondary loop by a pump rated at 240gpm, but each AHU has a booster pump to ensure adequate flow rate. The cooling plant has a 188 Ton air-cooled chiller on the roof and two pumps pumping the chilled water to the five AHUs at 183gpm each.

In addition to the AHUs, the Main Building also has 18 cabinet or standard Unit Heaters and 12 Exhaust Fans. The childcare furnace has its own source of cooling, a 5 Ton DX condenser outside on the ground.

Academic Expansion Building

The Academic Expansion also has five VAV AHUs, three of which have Air-to-Air heat exchangers for the incoming minimum outside air. In addition, they have economizer dampers for additional free cooling. There are a total of 61 VAV boxes that serve the area, 30 in the south addition and 31 in the west addition. There are six cabinet or standard unit heats in the entrances and stairs. In addition, just like the Main Building, each of the AHUs get their heating and cooling from plants specific to this building.

The heating plant for the Academic Expansion has three different sized boilers and a single pump sized at 60 gpm. The cooling plant has a 67.5 Ton air-cooled chiller and a pump providing 174 gpm. There is also a server room with a separate mini-split system that provides 1.5 Tons of cooling.

Cultural Center Building

The Cultural Center contains a gym and 2 stories of classrooms. There are two AHU's: one constant volume system for the Gym and one VAV system for the classrooms. The VAV system has 29 VAV boxes and 56.4 Tons of DX cooling, while the gym system has 57.75 Tons of DX cooling. Both systems have hot water heat, which is provided by three identical boilers and a pump delivering 250 gpm to the secondary loop. There are also three primary loop pumps that run at 88 gpm, one for each boiler. There are five exhaust fans and three unit heaters.

Library Building

One AHU serves the Library. It is a VAV system with 20 VAV boxes. The AHU has 28.5 Tons of DX cooling and hot water heat provided by two small identical boilers. There are nine cabinet unit heaters and four exhaust fans.

Controls and Trending

The equipment at Fond du Lac is controlled by two different automation systems, one Johnson Controls system, and one Honeywell system. The Johnson Controls system is a Metasys system and covers the entire campus except for the Academic Expansion building. It is covered by a Honeywell SymmetrE system. The JCI system can trend points, but has limited availability for long periods. The data can be extracted to spreadsheets. The Honeywell system is capable of trending and data extraction. The entire campus has DDC actuation and control. Remote access is possible for both systems.

Lighting

Almost all of the lighting is T8 lighting with occupancy sensors on most offices and classrooms. There is some 175W Metal Halide HID lighting with photocells for the parking lots.

Energy Use Index and B3 Benchmark

The site Energy Use Index (EUI) for all buildings is 129.3 kBtu/sq ft, which is 11% lower than their B3 Benchmark of 146.2 kBtu/sq ft. The median site EUI for State of Minnesota buildings are 23% lower than their corresponding B3 Benchmarks. The average EUI for MNSCU campuses is 88.4 kBtu/sq ft. This indicates that the Fond du Lac has the potential to further reduce its energy use.

Metering

There are four electric meters and five gas meters. The Main building, Academic Expansion, Lester Jack Briggs Cultural Center, and Ruth A Myers Library Expansion is all on one electric and one gas meter. The Student Housing and Teacher Education Building is on another electric meter, but they are on separate gas meters. House 1 and 2 are both on their own electric and gas meters.

Documentation

There is mechanical documentation, including building plans, equipment schedules, operations and maintenance manuals available on-site. The plans are located at the facility manager and in good order and condition.

Buildings Not Recommended for Investigation

Mechanical Equipment Summary Table	
2	Air Handlers
33	Exhaust Fans
4	Hot Water Boilers
12	Pumps (HW, CHW, etc)
1	Heat Exchanger
29	Water Source Heat Pumps
1	Cooling Tower

Student Housing

The Student Housing is different from the rest of the campus in that the heating and cooling is provided by a heat pump in each unit. The heat pumps are water source and the core water loop gets heated by four identical boilers that also provide heat to the domestic hot water loop through a heat exchanger. The cooling tower connected to the core water loop is not operational in the winter and is drained every year.

The Center of Excellence, Teacher Education Building, House 1 and House 2 are the remaining buildings that are not recommended for investigation. These buildings are not recommended for an investigation because they are small and have residential size furnaces with limited control.

Building Summary Tables

The following tables are based on information gathered from interviews with facility staff, building walk-through, automation system screen-captures, and equipment documentation. The purpose of these tables is to provide the size and quantity of equipment and the level of control present in each building. It is complete and accurate to the best of our knowledge. The buildings below are those being recommended for investigation.

Main Building
State ID# E26163C0192

Area (sq ft)	54,230	Year Built	1992	Occupancy (hrs/yr)	5,148

HVAC Equipment

Air Handlers (5 Total)

Description	Type	Size	Notes
AHU-1	VAV Air handler	SF 10,340 cfm, 15hp RF 9,905 cfm, 5hp 15 kBtu/h HW Heat	Has 23 lb/hr Humidifier and 11 gpm, 1/20 HP HW Booster Pump. Has 17 VAV boxes.
AHU-2	VAV Air handler	SF 11,780 cfm, 15hp RF 11,490 cfm, 7.5hp 15 kBtu/h HW Heat	Has 30 lb/hr Humidifier and 12 gpm, 1/12 HP HW Booster Pump Has 14 VAV boxes.
AHU-3	VAV Air handler	SF 15,100 cfm, 20hp RF 14,850 cfm, 10hp 20 kBtu/h HW Heat	Has 73 lb/hr Humidifier and 16 gpm, 1/16HP HW Booster Pump Has 10 VAV boxes.
AHU-4	VAV Air handler	SF 15,100 cfm, 20hp RF 14,850 cfm, 10hp 20 kBtu/h HW Heat	Has 73 lb/hr Humidifier and 16 gpm, 1/16HP HW Booster Pump Has 12 VAV boxes.
AHU-5	VAV Air handler	SF 25,640 cfm, 25hp RF 19,310 cfm, 15hp 25 kBtu/h HW Heat	Has 125 lb/hr Humidifier and 22 gpm, 1/6 HP HW Booster Pump Has 20 VAV boxes.
AHU-6	Furnace	SF 2,170 cfm, 137 kBtu/h Heat, 5 Tons DX Cooling	Serves Daycare

VAV Boxes (73 Total)

Description	Type	Size	Notes
VAV Boxes		175-2,565 cfm each	HW reheat

Cooling System

Description	Type	Size	Notes
CH-1	Air Cooled	187.9 Tons, 365 gpm	
CHWP-1	Pump	183 gpm, 7.5 HP	CHW Pump
CHWP-2	Pump	183 gpm, 7.5 HP	CHW Pump

Heating System

Description	Type	Size	Notes
Boiler 1-6	HW Boiler	534.5 kBtu/h (6X)	6 identical boilers
HP 1	Pump	240 gpm, 7.5 HP	Secondary loop HWP
HP 2	Pump	240 gpm, 7.5 HP	Secondary loop HWP
HP 3	Pump	40 gpm, 1/6 HP	Boiler Pump
HP 8	Pump	40 gpm, 1/6 HP	Boiler Pump

Main Building (cont.)
HVAC Equipment Cont

Cabinet Unit Heaters (12 Total)

Description	Type	Size	Notes
7 CUHs	HW Cabinet Unit Heaters	23.8 to 40.5 kBtu/h	

Unit Heaters (6 Total)

Description	Type	Size	Notes
6 UHs	HW Unit Heaters	14.9 to 22 kBtu/h	

Exhaust Fans (12 Total)

Description	Type	Size	Notes
EF 1	Exhaust Fan	1,160 cfm, 1 HP	
EF 2	Exhaust Fan	380 cfm, 1/4 HP	
EF 3	Exhaust Fan	340 cfm, 1/4 HP	
EF 4	Exhaust Fan	1,360 cfm, 1/3 HP	
EF 5	Exhaust Fan	325 cfm, 1/4 HP	
EF 6	Exhaust Fan	65 cfm, FRAC	
EF 7	Exhaust Fan	100 cfm, FRAC	
EF 8	Exhaust Fan	3,250 cfm, 3HP	
EF 9	Exhaust Fan	1,000 cfm, 1/2 HP	
EF 10	Exhaust Fan	325 cfm, 1/4 HP	
VFI	Fan	1,600 cfm, 1/3 Hp	
VF 2	Fan	3,350 cfm, 1/5 HP	

Points on BAS (Metasys)

Air Handlers

Description	Points
AHU 1, 2, 3, 4, & 5	OAT, MAT, DAT, ZN-T, RA-RH, RAT, DSP and Setpoint, RA-CO2, SF-S and Speed, RF-S, OAD Position, HTG-VALVE, CLG-VALVE, Humidifier Valve Pos, HW Pumps Status

VAV Boxes

Description	Points
Each Unit	Actual airflow (cfm), Calculated airflow (cfm), Cooling setpoint, Heating setpoint, Heating valve, Zone temp

Cooling System

Description	Points
	Chiller Status, CHWST, CHWRT, OAT, OARH, CHWP 1 & 2 Status

Heating System

Description	Points
	OAT, Boiler 1-6 Enable, HWST and setpoint, HWRT, HW diff pressure, Pump 1 and 2 status, OAT Enable setpoint

Exhaust Fans

Description	Points
EF-1, 2, 3, 4, 6	EF status

Academic Expansion State ID# E26163C0302					
Area (sq ft)	39,720	Year Built	2002	Occupancy (hrs/yr)	5,148
HVAC Equipment					

Air Handlers (5 Total)

Description	Type	Size	Notes
AHU-1	VAV AHU	SF 7,000 cfm 7.5 hp. RF 4,800cfm 5hp	Has Air-to-Air heat exchanger of 4200cfm. Serves South Wing
AHU-2	VAV AHU	SF 10,500 cfm 15 hp RF 8,700 cfm 10hp	Has Air-to-Air heat exchanger of 6300cfm. Serves South Wing
AHU-3	VAV AHU	SF 3,750 cfm 5hp, RF 3,750 cfm 5 hp	Has Air-to-Air heat exchanger of 5875cfm. Serves Auditorium
AHU-4	VAV AHU	SF 2,000 cfm, 1.5 hp	Serves Computer Lab
AHU-5	VAV AHU	SF 11,000 cfm 7.5hp, RF 9,600 cfm 5 hp	Serves West Wing

VAV Boxes (61 Total)

Description	Type	Size	Notes
VAV Boxes	HW reheat	180-1,600 cfm max each	30 in South Wing, 31 in West Wing.

Cooling System

Description	Type	Size	Notes
CH-2	Air-Cooled Chiller	67.5 Tons, 175 gpm	
CP 4	Pump	175 gpm	Building CHW
CP 5	Pump	175 gpm	Building CHW
ACU-1		18.2 kBtu/h.	Serves Server room 225, 685 cfm 0.75hp Evap fan, 0.50hp Cond fan

Heating System

Description	Type	Size	Notes
B1	Boiler	250 kBtu/h	Serves South Addition
B2	Boiler	250 kBtu/h	Serves South Addition
B3	Boiler	250 kBtu/h	Serves South Addition
CP 2	Pump	1hp, 60 gpm	Building HW Supply
CP 3	Pump	1hp, 60 gpm	Building HW Supply

Cabinet Unit Heaters (3 Total)

Description	Type	Size	Notes
3 CUHs	HW Cabinet Unit Heaters	22.9 to 49.4 kBtu/h	Serves vestibules

Unit Heaters (3 Total)

Description	Type	Size	Notes
3 UHs	HW Cabinet Unit Heaters	14.3 kBtu/h	Serves mechanical rooms

Exhaust Fans (6 Total)

Description	Type	Size	Notes
EF-1	Exhaust Fan	350 cfm	Serves West Wing
EF-2	Exhaust Fan	550 cfm	Serves Fume Hood
EF-3	Exhaust Fan	550 cfm	Serves Fume Hood
EF-4	Exhaust Fan	550 cfm	Serves Fume Hood
EF-5	Exhaust Fan	1,250 cfm	Serves Lab prep and Storage rooms
EF-6	Exhaust Fan	1,980 cfm	Serves South Wing

Academic Expansion (cont)
Points on BAS (Honeywell)

Air Handlers

Description	Points
AHU 1	OAT, OARH, MAT, DAT and setpoint, RA-RH, RAT, DSP and Setpoint, SF-S and Speed, OA Damper Position, HTG-VALVE, CLG-VALVE, OA cfm and min flow setpoint, SF cfm, RF cfm, Morning Warm-up Setpoint, Night setback temp
AHU 2 AHU 3	OAT, OARH, MAT, DAT and setpoint, RA-RH, RAT, DSP and Setpoint, SF-S and Speed, OAD Position, HTG-VALVE, CLG-VALVE, OA cfm and Min flow setpoint, SF cfm, RF cfm, Morning Warm-up Setpoint, Night setback temp, Heat wheel DAT, Heat wheel EAT, Heat wheel by-pass damper and Enable temp setpoint
AHU 3	OAT, OARH, MAT, DAT and Setpoint, RA-RH, RAT, DSP and Setpoint, SF-S and Speed, OAD Position, HTG-VALVE, CLG-VALVE, OA cfm and Min flow setpoint, SF cfm, RF cfm, Morning Warm-up setpoint, Night setback temp, Heat wheel DAT, Heat wheel EAT, Heat wheel by-pass damper and Enable temp setpoint
AHU 4	OAT, OARH, MAT, DAT and Setpoint, RA-RH, RAT, SF-S, OA Damper Position, HTG-VALVE, CLG-VALVE, OA cfm and min flow setpoint, Morning Warm-up Setpoint, Night setback temp,
AHU 5	OAT, OARH, MAT, DAT and Setpoint, RA-RH, RAT, DSP and Setpoint, SF-S and Speed, RF-S, OAD Position, HTG-VALVE, CLG-VALVE, OA cfm and Min flow setpoint, SF cfm, RF cfm, Morning Warm-up Setpoint, Night setback temp

VAV Boxes

Description	Points
Each Unit	Actual airflow (cfm), Calculated airflow (cfm), Cooling setpoint, Heating setpoint, Heating valve, Zone temp

Cooling System

Description	Points
	Chiller Enable and Status for Compressor 1 & 2, CHWST, CHWRT, OAT, CHWP 1 & 2 Status, Chiller Enable Setpoint

Heating System

Description	Points
	OAT, Boiler 1-3 Enable, HW Demand, HWST and Setpoint, HWRT, Pump 2 and 3 status

Exhaust Fans

Description	Points
EF-1, 2, 3, 4, 5, 6	EF status

Unit Heaters

Description	Points
UH-1, 2, 3	ZN-T and Setpoint, Status

Floor Plans

Description	Points
	ZN-T, VAV box location

Lester Jack Briggs Cultural Center State ID# E26163C0608					
Area (sq ft)	34,300	Year Built	2008	Occupancy (hrs/yr)	5,148
HVAC Equipment					

Air Handlers (2 Total)

Description	Type	Size	Notes
AHU 7	VAV Air handler	SF 21,500cfm, 25hp RF 16,400cfm, 7.5hp 56.4 Tons DX Cool 322.5 kBtu/h HW Heat	Has 29 VAV boxes
AHU 8	CV Air handler	SF 22,000cfm, 20hp RF 22,000cfm, 7.5hp 57.75 Tons DX Cool 1,027 kBtu/h HW Heat	Serves Gym. Has 2 stages of DX Cooling.

VAV Boxes (29 Total)

Description	Type	Size	Notes
VAV Boxes	HW reheat	80-4,000 cfm max each	

Heating System

Description	Type	Size	Notes
BR 3	Boiler	1,000 kBtu/h	Having problems controlling HWS-T
BR 4	Boiler	1,000 kBtu/h	Having problems controlling HWS-T
BR 5	Boiler	1,000 kBtu/h	Having problems controlling HWS-T
HWSP 1	Pump	250 gpm 7.5 HP	Secondary loop. Has VFD
HWSP 2	Pump	250 gpm 7.5 HP	Secondary loop. Has VFD
HWPP 1	Pump	88 gpm 1 HP	Primary loop
HWPP 2	Pump	88 gpm 1 HP	Primary loop
HWPP 3	Pump	88 gpm 1 HP	Primary loop

Unit Heaters (3 Total)

Description	Type	Size	Notes
3 UHs	HW Unit Heaters	17.8 to 30 kBtu/h	Serves mechanical rooms

Exhaust Fans (12 Total)

Description	Type	Size	Notes
EF 3	Exhaust Fan	670 CFM 1/3 HP	Elec Room in Cultural Ctr
EF 4	Exhaust Fan	4,220 CFM 3 HP	Restrooms in Cultural Ctr
EF 7	Exhaust Fan	2,050 CFM, 1/4 Hp	Penthouse in Cultural Ctr
EF 8	Exhaust Fan	1,300 CFM 1/4 HP	Gym
EF 9	Exhaust Fan	405 CFM 1/4 HP	Elev Equip in Cultural Ctr

Lester Jack Briggs Cultural Center (cont)
Points on BAS (Metasys)

Air Handlers

Description	Points
AHU 7	OAT, OARH, MAT, DAT and Setpoint, RA-RH, RAT, RA-CO2, DSP and Setpoint, SF-S and Speed, RF Status and Speed, OA Damper Position, HTG-VALVE, DX Stage 1& 2 Command, ZN-T
AHU 8	OAT, OARH, MAT, DAT and setpoint, RARH, RAT, RA-CO2, DSP and Setpoint, SF-S and Speed, RF Status and Speed, OA Damper Position, HTG-VALVE, DX Stage 1& 2 Command, OA cfm and min flow setpoint, SF cfm, RF cfm, Diff Enthalpy Setpoint, ZN-T

VAV Boxes

Description	Points
Each Unit	Actual airflow (cfm), Calculated airflow (cfm), Cooling setpoint, Heating setpoint, Heating valve, Zone temp

Heating System

Description	Points
	OAT, HWST and setpoint, HWRT, HWDP and Setpoint, Boiler Status, Pump 2, 3, 4, & 5 Status, Pump Speed

Exhaust Fans

Description	Points
EF-3, 4, 5, 7, 8, 9	EF status

Unit Heaters

Description	Points
UH-1, 2, 3	ZN-T and Setpoint, Status

Lighting

Description	Points
	Schedule and Command of 5 different lighting areas.

Ruth A Myers Library Expansion State ID# E26163C0508					
Area (sq ft)	12,400	Year Built	2008	Occupancy (hrs/yr)	2,288
HVAC Equipment					

Air Handlers (2 Total)

Description	Type	Size	Notes
AHU 6	Air handler	SF 8,000cfm, 10hp RF 8,000cfm, 3hp 28.5 Tons DX Cool 217 kBtu/h HW Heat	Has 20 VAV boxes

VAV Boxes (20 Total)

Description	Type	Size	Notes
VAV Boxes	HW reheat	100 to 1,220 cfm max each	

Heating System

Description	Type	Size	Notes
BR 1	Boiler	500 kBtu/h	
BR 2	Boiler	500 kBtu/h	
HWSP 3	Pump	70 gpm 3HP	Secondary loop. Has VFD
HWSP 4	Pump	70 gpm 3HP	Secondary loop. Has VFD
HWPP 4	Pump	44 gpm 1/4 HP	Primary loop
HWPP 5	Pump	44 gpm 1/4 HP	Primary loop

Cabinet Unit Heaters (3 Total)

Description	Type	Size	Notes
9 CUHs	HW Cabinet Unit Heaters	13.5 to 45 kBtu/h	Serves vestibules and stairs

Exhaust Fans (4 Total)

Description	Type	Size	Notes
EF 1	Exhaust Fan	300cfm 1/4 HP	Restroom in Library
EF 2	Exhaust Fan	200 cfm 1/4 HP	Library Penthouse
EF 5	Exhaust Fan	440 cfm 1/4 HP	Kitchen
EF 6	Exhaust Fan	1,300 cfm 1/4 HP	Library

Ruth A Myers Library Expansion (cont)
Points on BAS (Metasys)

Air Handlers

Description	Points
AHU-6	OAT, OARH, MAT, DAT and Setpoint, RA-RH, RAT, RACO2, DSP and Setpoint, SF-S and Speed, RF Status and Speed, OA Damper Position, HTG-VALVE, DX Stage 1& 2 Command, OA cfm and Min flow setpoint, SF cfm, RF cfm, Diff Enthalpy Setpoint, ZN-T

VAV Boxes

Description	Points
Each Unit	Actual airflow (cfm), Calculated airflow (cfm), Cooling setpoint, Heating setpoint, Heating valve, Zone temp, damper Pos, Box mode,

Heating System

Description	Points
	OAT, HWST and Setpoint, HWRT, HWDP and Setpoint, Boiler Status, Pump 1, 2, 4, 5 Status, Pump Speed,

Exhaust Fans

Description	Points
EF-1, 2, 5, 6	EF status

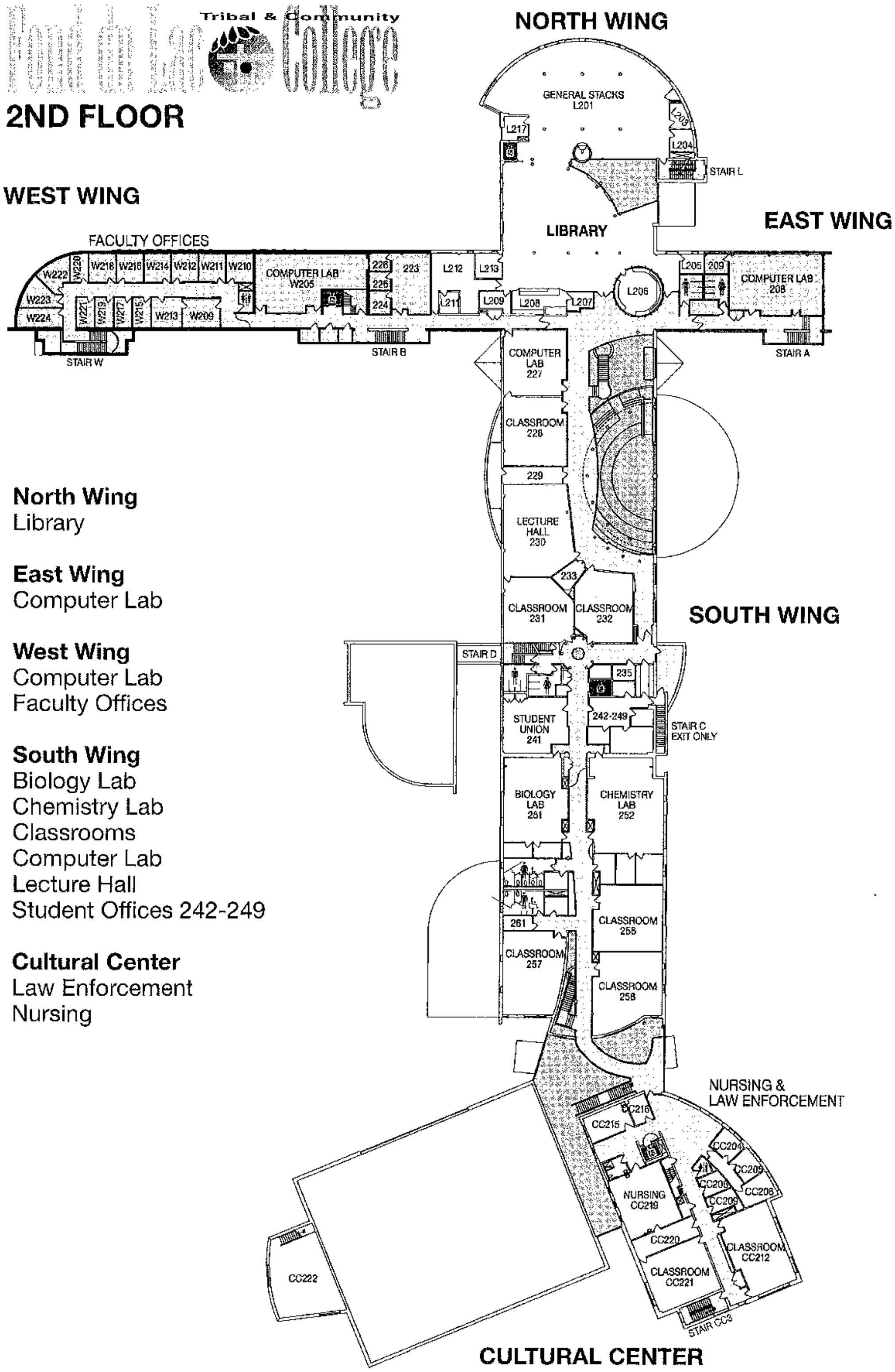
Unit Heaters

Description	Points
UH-1, 2, 3	ZN-T and setpoint, Status

Lighting

Description	Points
	Schedule and Command of 2 different lighting areas.

Building Floor Plans


Fond du Lac Tribal & Community College
2ND FLOOR
NORTH WING
WEST WING
EAST WING
SOUTH WING
CULTURAL CENTER
GENERAL STACKS
L201
LIBRARY
STAIR L
FACULTY OFFICES
COMPUTER LAB
W205
COMPUTER LAB
208
STAIR W
STAIR B
STAIR A
COMPUTER LAB
227
CLASSROOM
228
229
LECTURE HALL
230
233
CLASSROOM
231
CLASSROOM
232
STAIR D
235
STUDENT UNION
241
242-249
STAIR C
EXIT ONLY
BIOLOGY LAB
251
CHEMISTRY LAB
252
261
CLASSROOM
255
CLASSROOM
257
CLASSROOM
258
NURSING &
LAW ENFORCEMENT
CC215
NURSING
CC219
CC220
CLASSROOM
CC221
CLASSROOM
CC212
CC222
STAIR CC3
North Wing
Library
East Wing
Computer Lab
West Wing
Computer Lab
Faculty Offices
South Wing
Biology Lab
Chemistry Lab
Classrooms
Computer Lab
Lecture Hall
Student Offices 242-249
Cultural Center
Law Enforcement
Nursing

PBEEEP Abbreviation Descriptions			
AHU	Air Handling Unit	HP	Horsepower
BAS	Building Automation System	HRU	Heat Recovery Unit
CD	Cold Deck	HW	Hot Water
CDW	Condenser Water	HWDP	Hot Water Differential Pressure
CDWRT	Condenser Water Return Temperature	HWP	Hot Water Pump
CDWST	Condenser Water Supply Temperature	HWRT	Hot Water Return Temperature
CFM	Cubic Feet per Minute	HWST	Hot Water Supply Temperature
CHW	Chilled Water	HX	Heat Exchanger
CHWRT	Chilled Water Return Temperature	kW	Kilowatt
CHWDP	Chilled Water Differential Pressure	kWh	Kilowatt-hour
CHWP	Chilled Water Pump	MA	Mixed Air
CHWST	Chilled Water Supply Temperature	MA Enth	Mixed Air Enthalpy
CRAC	Computer Room Air Conditioner	MARH	Mixed Air Relative Humidity
CV	Constant Volume	MAT	Mixed Air Temperature
DA	Discharge Air	MAU	Make-up Air Unit
DA Enth	Discharge Air Enthalpy	OA	Outside Air
DARH	Discharge Air Relative Humidity	OA Enth	Outside Air Enthalpy
DAT	Discharge Air Temperature	OARH	Outside Air Relative Humidity
DDC	Direct Digital Control	OAT	Outside Air Temperature
DP	Differential Pressure	Occ	Occupied
DSP	Duct Static Pressure	PTAC	Packaged Terminal Air Conditioner
DX	Direct Expansion	RA	Return Air
EA	Exhaust Air	RA Enth	Return Air Enthalpy
EAT	Exhaust Air Temperature	RARH	Return Air Relative Humidity
Econ	Economizer	RAT	Return Air Temperature
EF	Exhaust Fan	RF	Return Fan
Enth	Enthalpy	RH	Relative Humidity
ERU	Energy Recovery Unit	RTU	Rooftop Unit
FCU	Fan Coil Unit	SF	Supply Fan
FPVAV	Fan Powered VAV	Unocc	Unoccupied
FTR	Fin Tube Radiation	VAV	Variable Air Volume
GPM	Gallons per Minute	VFD	Variable Frequency Drive
HD	Hot Deck	VIGV	Variable Inlet Guide Vanes

Conversions
1 kWh = 3.412 kBtu
1 Therm = 100 kBtu
1 kBtu/hr = 1 MBH